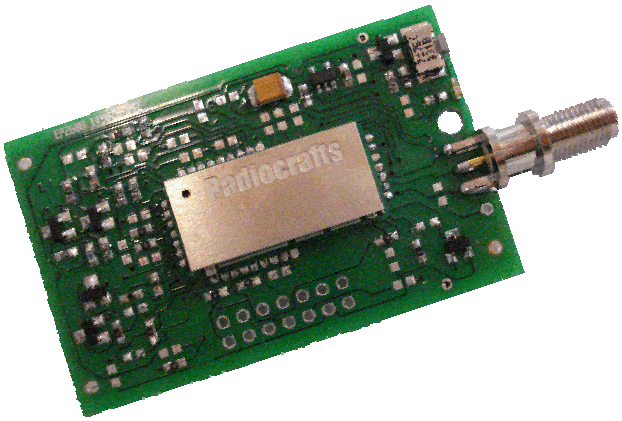
Radiocrafts
Embedded Wireless Solutions

RC-IESM-Series

Radiocrafts IESM-Series Expansion Cards User Manual



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Quick Start Guide

How do I set up a simple link between an IESM board and a matching Radiocrafts RF module?

A basic communication test can be done by sending and receiving serial data via the external RS232 (UART1) on the Wavecom modem to and from a Radiocrafts Demonstration Board, after downloading the RTG-demonstration software into the modem and enabling serial-to-serial mode:

- Attach the antennas to the SMA connectors
- Download the latest version of RCTools from www.radiocrafts.com
- Install RCTools (this will also install the USB VCP (Virtual COM Port) driver)
- Connect the modem RS232 port, and the USB port on the Demo Board, to a PC
- Start a terminal program on the PC (like RC_CCT or Microsoft HyperTerminal). Make sure to select the correct serial port. Set Baud rate 19200, 1 start bit, no parity, 1 stop bit, no flow control for the Demo Board. Set Baud rate 115200,1 start bit, no parity, 1 stop bit, hardware flow control for the Wavecom modem
- Wavecom modem: Connect the battery eliminator plug to the DC jack. Put the battery eliminator in the wall outlet socket. Download the RTG-demonstration software into the modem and enable serial-to-serial mode
- For using RC2300-ZNM-IESM, change the UART2 setting to 115200 Baud and enable Hardware flow control, see the RTG User Manual. Other settings as above will meet the default settings of the RTG Software.

The modules will now be in idle mode listening for a valid data packet to arrive.

You can now enter data in one terminal window and after approximately 2 seconds timeout, the ASCII string is transmitted to the other module and shown in the other terminal window if the transmission was successful.

For Wireless M-Bus and ZigBee (ZNM) the communication should be done via the RCTools named MBUS-DEMO and ZNM-CCT respectively.

For a detailed description on how to find the right COM Port to use, and how to connect to, and use, the Demonstration Board, please see the RCxxxxDK-USB_User_Manual or RC2300DK-ZNM_Quick_Start available at www.radiocrafts.com.

How do I go on and change the RF channel or any other parameter?

To change configurable parameters on the Demonstration Board or IESM board, assert the CONFIG pin (pulling low), and send the command string using the same serial interface as for transmitting data. Parameters can be changed permanently and stored in non-volatile memory in the module. See following sections on how to enter configuration mode for the various IESM boards.

> NOTE! Always extract the IESM board from the modem by using an angled tool/hook inserted into the 3.2 mm hole in front of the IESM board. The GPC connector require a significant force to release its mating connector, thus never use other tools for extracting the IESM board as this may permanently damage the board.

Product Description

The RC-IESM (Internal ExpanSion Module) series of expansion cards for the Wavecom Fastrack Supreme modems contains an RF module which interfaces to the UART serial bus inside the modem, and an SMA connector for the external antenna. The RF module is a Wireless M-Bus module, a ZigBee module, or any module from the RC232 protocol family from Radiocrafts. An embedded protocol inside the RF module handles all RF communication and only data payload and easy-to-use commands are sent over the UART serial bus. The PCB is the same for all modules which only requires different BOM (Bill of Material) to support the various protocols.

The Wavecom Fastrack Supreme M2M modems contain a powerful microcontroller handling the GPRS/GMS/Edge communication and the serial communication towards the RF module. An Open AT demonstration software is available for download, enabling a fully working demonstration gateway to be established with minimum design effort. The software can be modified and tailored to fit numerous applications.

Supported Protocols and Network Standards

- Wireless M-Bus
- IEEE 802.15.4
- ZigBee
- 6LoWPAN
- RC232 (proprietary)

Applications

GSM/GPRS/EDGE gateway solutions for:

- AMR / Smart Metering
- Home automation, building automation and industrial automation
- Fleet and inventory management
- Wireless sensor networks

Features

- GSM/GPRS/EDGE Gateway for Wireless M-Bus, ZigBee and RC232
- On-board radio module with embedded protocol
- Easy-to-use UART interface connects to powerful Wavecom-internal ARM9 processor
- RF interface with SMA connector connects to standard antennas
- Same PCB supports modules from a large portfolio of RF modules
- Miniature manual switch and LED (connects to ARM-processor)
- Free open AT-command based demo software for socket connection and module configuration
- CE certified
- FCC pre-qualified for dedicated RF modules

Functional block diagram for Wavecom modem and Radiocrafts IESM boards

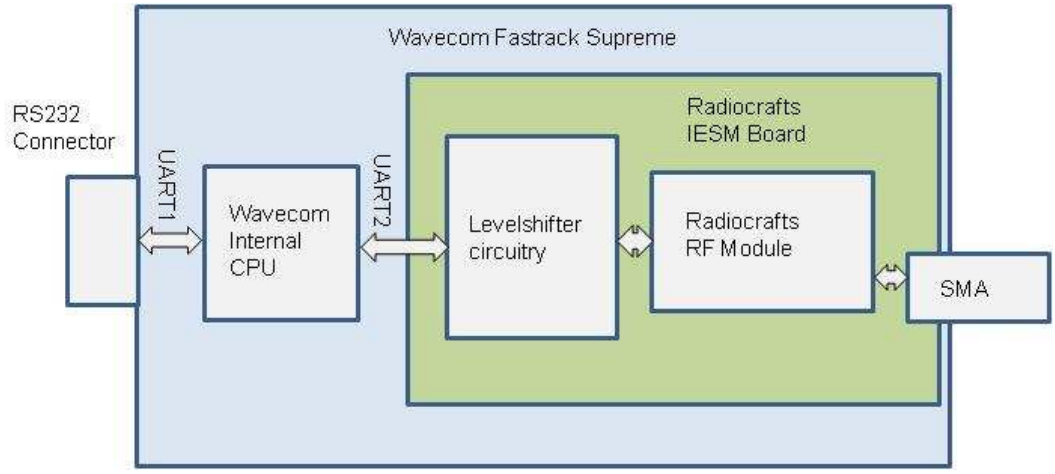

Figure 1: Functional block diagram

Demonstration firmware and source code for the Wavecom modem

Demonstration software for enabling a socket connection for transparent GPRS payload transfer, and for enabling RF modem configuration, is available from Radiocrafts and Asvito, www.asvito.no. See the RTG User Manual for details on the RTG (Radio Test Gateway) software available for the Wavecom modem.

Wavecom modem embedded resources and tools

MCU:	ARM9 32 bit, 26-104 MHz core
IDE:	Open AT IDE, Integrated Development Environment, where applications can be written, compiled, downloaded and monitored through the debugging phase of the development
Software:	Standard ANSI C, Open AT built on Eclipse, a fully integrated tool chain encompassing CDT, Terminal Emulator, Target Monitor, Compiler, Downloader and Supervisor

Functional Layout

The ARM9 processor connects to the IESM board via a 50-pin GPC, General Purpose Connector, mounted on the secondary side of the board. The antenna connector is a standard SMA connector.

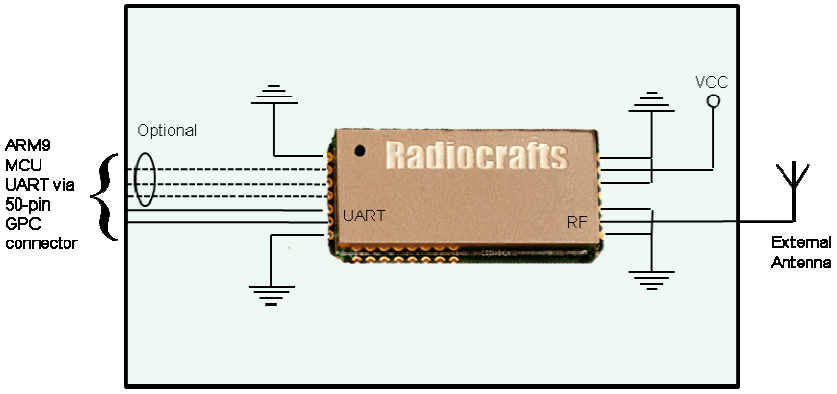

Figure 2: IESM board functional connection

Antenna connection

A quarter wave antenna can be directly connected to the SMA antenna connector. If the modem is placed in environments where RF performance is reduced, an external antenna can be connected via an extension coaxial cable to the SMA connector. It is strongly recommended that the Wavecom GPRS antenna and the IESM antenna is not pointing in the same direction to reduce possible interference and range reductions; Thus, use angled GPRS antenna if straight antenna is used with the IESM card, and vice versa.

GPC, General Purpose Connector, Pin Description

Pin no	Pin name	Description and internal MCU connection
1-2	GND	System ground
3-15	NC	Not Connected
16	GPIO28	Reset_N
17-22	NC	Not Connected
23	RXD2	Connects to the module's RXD-pin
24	TXD2	Connects to the module's TXD-pin
25	CTS2	Connects to the module's CTS-pin
26	RTS2	Connects to the module's RTS-pin
27-28	NC	Not Connected
29	GPIO19	Push Button
30	NC	Not Connected
31	GPIO20	LED (green)
32	NC	Not Connected
33	GPIO23	Config (enable module configuration mode)
34	NC	Not Connected
35	DTR1	Pull-up to pin 41
36-40	NC	Not Connected
41	VCC-2V8	Used for board-internal pull-up
42	GND	System ground
43-44	NC	Not Connected
45	GND	System ground
46-47	4V	Connected to modules VCC pin via on-board Low Dropout Regulator
48-50	GND	System ground

Data from UART1 via UART2 for module configuration and communication

For detailed instructions on how to handle I/O's on the GPC connector and for changing UART1 and UART2 Baud rates and handshake, see the RTG User Manual.
Common to all IESM-boards:

- UART2 default settings are 19200 Baud, no parity, 1 start and stop bit, no handshake. These are also the default settings for all IESM boards except RC2300-ZNM-IESM, thus no modification of UART2 settings is required. For using RC2300-ZNM-IESM, see below.
  1. Connect a HyperTerminal window to UART1 as described in the Quick Start section
  2. Switch off hardware handshake on UART2 via AT+IPC=0,0
  3. Release the COM-port

RC232 protocol modules

See the related document RC232-CCT User Manual for a detailed description on how to use the RCtool for configuration and communication with the module with the embedded RC232 protocol. Follow 1-3 above, then;

- Start the CCT program
- Connect to the correct COM-port (normally COM1, RS232-port)
- Wireless communication to another module (or module on a Demo Board) can directly be done by entering text strings at the Terminal Line
- Enter transparent UART-UART mode via sending AT+MODE=2 in the Terminal Line, tick for CR+LF
- To enter configuration mode for the module, place the text AT+GPIO=1,0,4 in the Terminal Line. Tick for CR+LF and send the text with the right-pointing arrow
- Press the configure button in CCT; The program now displays "waiting for prompt sign (..)"
- Go to the arrow to the right of the Terminal Line and send a single character 'Y'
- The module has entered configuration mode and now responds with the prompt, making it possible to read back data and change requested locations
- Change parameters as described in the CCT User Manual
- After exiting configuration mode and before being able to communicate in transparent mode, write +++ and wait for response followed by AT+GPIO=1,1,4 in the Terminal Line to set the Config-pin high

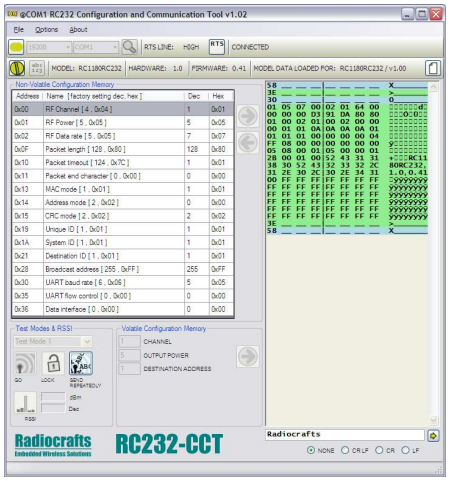

Figure 3: RC232-CCT Window

MBUS protocol modules
See the related document MBUS-CCT User Manual for a detailed description on how to use the RCtool for configuration and communication with the module with the embedded Wireless M-Bus protocol. Follow 1-3 on previous page, then;

- Start the CCT program
- Connect to the correct COM-port
- Wireless communication to another module (or module on a Demo Board) can directly be done by entering text strings in the Terminal Line. Remember that first byte in transmission has to be string length byte (including length byte itself)
- Enter transparent UART-UART mode via sending AT+MODE=2 in the Terminal Line, tick for CR+LF
- Press the configure button, the module now enters configuration mode
- Change parameters as described in the CCT User Manual
- The CCT-program handles all UART instructions required to enter and leave configuration mode and entering terminal mode

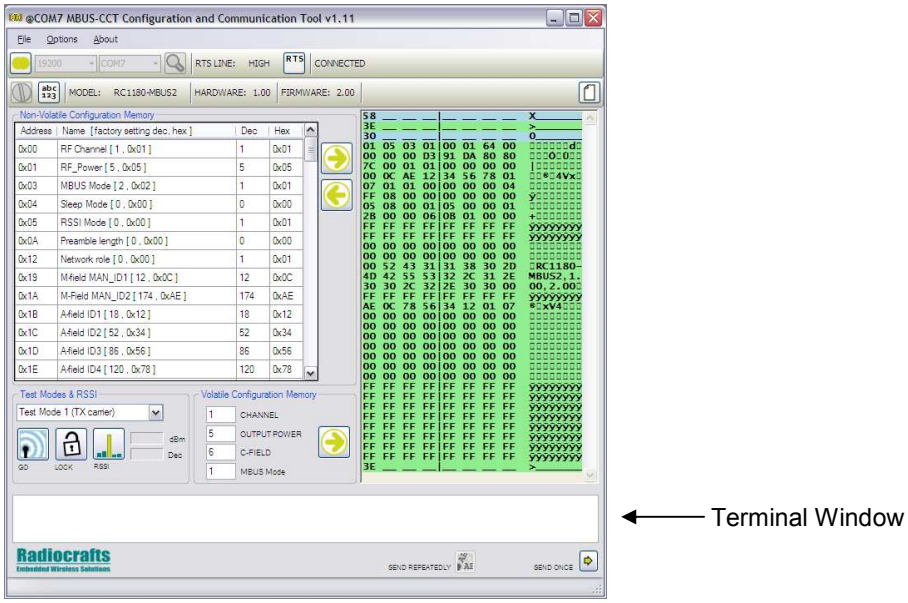

Figure 4: MBUS-CCT Window

ZNM protocol modules.
See the related document RC2300-ZNM Demonstration Kit Quick Start (including ZNM-CCT User Manual) for a detailed description on how to use the RCtool for configuration and communication with the module with the embedded ZNM protocol.

- Connect to correct COM-port via HyperTerminal using same settings as in Quick Start section
- Set UART1 to ZNM default settings, 115200 baud and hardware handshake, via command AT+MSER=115200,1
- Restart modem via command AT+CFUN=1
- Disconnect HyperTerminal and connect ZNM-CCT to the same COM-port

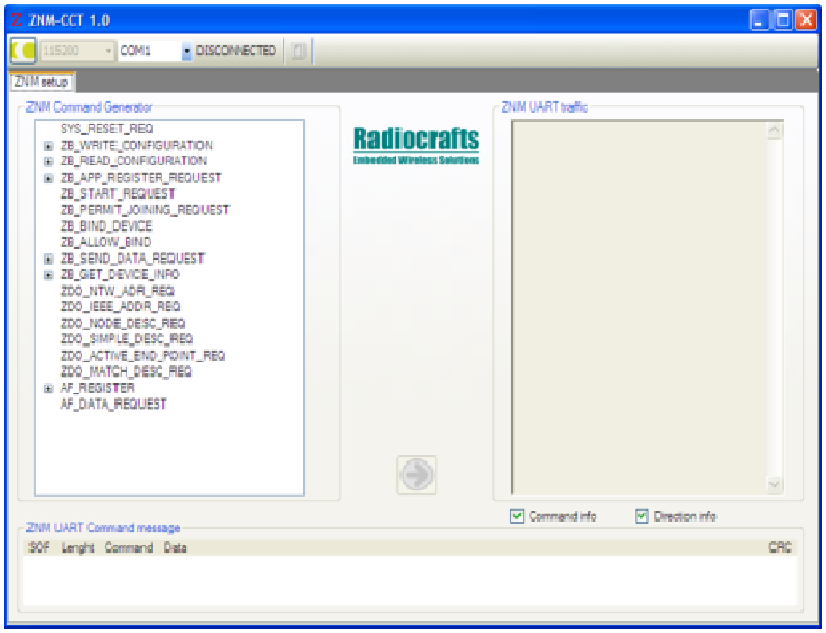

Figure 5: ZNM Window

RC-IESM Circuit Diagram

The circuit diagram of the RC-IESM board is shown in figure 6. A full resolution schematic is found in RC_IESM_2_0.zip available from Radiocrafts' webpage.

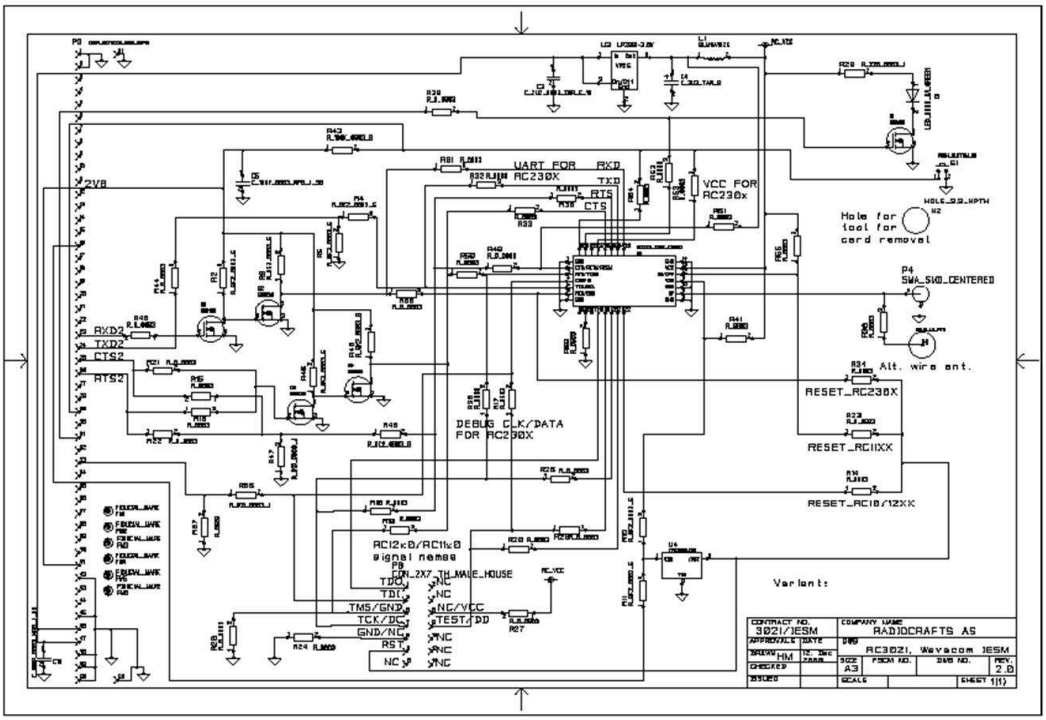

Figure 6: RC-IESM Circuit diagram

RC-IESM PCB and Assembly layout

The PCB is a simple 2-layer board where Layer 2 is used as ground plane. The laminate used is standard FR-4 board material. The PCB is 1.0 mm thick. Full resolution layout and assembly drawing are found in RC_IESM_2_0.zip.

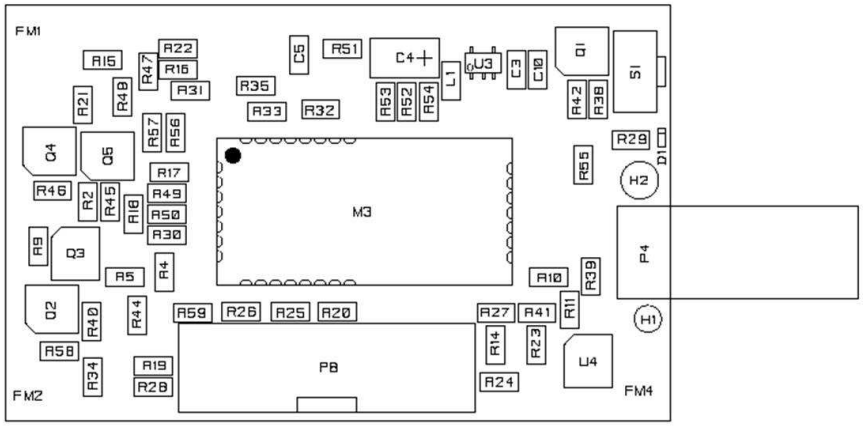

Figure 7: RC-IESM PCB component placement, top side

RC-IESM Bill of Materials

The circuit diagram includes all components of the RC-IESM. Note that RC11xx, RC12x0/2x00 and RC2300 all requires different component mounting. Details are listed in the following tables. Components not to be mounted are marked *DNM (Do Not Mount)* in the 'Quantity' column.

RC-IESM Bill of materials for RC11xx			
Reference	*Quantity*	*Part number*	*Description*
L1	1	BLM11A102S	EMI filter bead
Q1-5	5	BSS138	MOSFET, N, 50V, 1.6V threshold
P3	1	CONN_WAVECOM_IESM_50PIN	50-pin connector, plug, 0.5 mm pitch
P8	1 *(DNM)*	CON_2X7_TH_MALE_HOUSE	Connector 14 pins, pin header in house
C5;C10	2	C_100P_0603_NP0_J_50	Capacitor, 0603
C3	1	C_2U2_0603_X5R_K_10	Capacitor, 0603
C4	1	C_3U3_TAN_B	Capacitor, tantal
FM1-6	6 *(DNM)*	FIDUCIAL_MARK	Fiducial mark
H1	1 *(DNM)*	HOLE_1.0_PTH	Hole, 1.0mm, PTH
H2	1 *(DNM)*	HOLE_3.2_NPTH	Hole, NPTH
D1	1	LED_0603_RA_GREEN	LED, 0603 size Right Angle, green
U3	1	LP2980-3.0V	3.0V low drop-out regulator
S1	1	PUSH_BUTTON_RA	Push button, SMD, Right angled
M3	1	RC1XX0_230X_COMBO	Radiocrafts RF Module
P4	1	SMA_SMD_CENTERED	SMA connector, Right Angle, PCB centred
U4	1	TPS3809J25	Voltage supervisor, 2.5V, SOT-23
R47;R56	2	R_1K0_0603_J	Resistor, 0603
R29	1	R_220_0603_J	Resistor, 0603
R2;R4-5;R9-11;R42;R45-46;R48	10	R_8K2_0603_G	Resistor, 0603
R14-20;R24;R30-35;R39;R50-55;R57;R59	23 *(DNM)*	R_0603	Resistor, 0603, general
R21-23;R25-28;R38;R40-41;R44;R49;R58	13	R_0_0603	Resistor, 0603

RC-IESM Bill of materials for RC10xx, RC12xx and RC2x00			
Reference	*Quantity*	*Part number*	*Description*
Same components as for RC11xx **except** for components R_0603 (DNM) and R_0_0603 (0-ohm)			
R15-17;R23;R25-28;R30-35;R39;R41;R50-54;R57;R59	23 *(DNM)*	R_0603	Resistor, 0603, general
R14;R18-22;R24;R38;R40;R44;R49;R58	12	R_0_0603	Resistor, 0603

RC-IESM Bill of materials for RC2300			
Reference	*Quantity*	*Part number*	*Description*
Same components as for RC11xx **except** for components R_0603 (DNM) and R_0_0603 (0-ohm)			
R14-16;R18-20;R23-26;R39;R49-50;R52-55;R57-58	19 *(DNM)*	R_0603	Resistor, 0603, general
R17;R21-22;R27-28;R30-35;R38;R40-41;R44;R51;R59	17	R_0_0603	Resistor, 0603

Mechanical Drawing

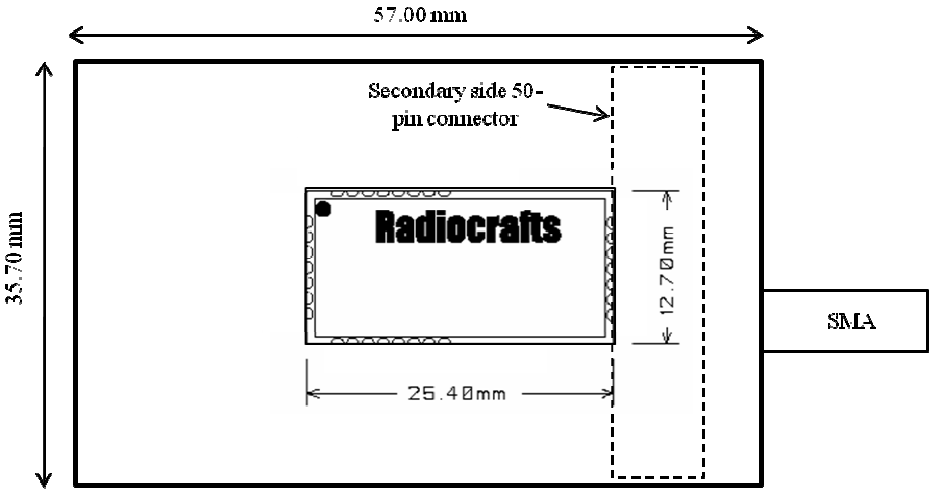

Figure 8: Mechanical drawing

Mechanical Dimensions

The board size is 35.7 x 57.0 x 4.1 mm (total height for PCB and module).

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Article Numbers

Ordering Number	Module Desription
RC1180-MBUS-IESM	Embedded Wireless M-Bus protocol (EN13757-4:2005, 868 MHz radio) for gas, water, heat and electricity meter readings
RC2300-ZNM-IESM	ZigBee Network Module
RC1140-RC232-IESM RC1180-RC232-IESM RC1190-RC232-IESM	433, 868 and 915 MHz high speed modules, RC232 protocol
RC1240-RC232-IESM RC1280-RC232-IESM RC1290-RC232-IESM	433, 868 and 915 MHz narrowband long range, RC232 protocol

Visit www.radiocrafts.com for product description of each module.

Document Revision History

Document Revision	Changes
1.0	First release

Disclaimer

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As far as possible, major changes of product specifications and functionality, will be stated in product specific Errata Notes published at the Radiocrafts website. Customers are encouraged to check regularly for the most recent updates on products and support tools.

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